Remarks

The present response amends claims 26, 32, 37, 38, 41, 44 and 46, cancels claims 48-51 and 54 without prejudice, and requests reconsideration of the rejected claims. Presently, claims 26-47, 52-53 and 55 are pending.

Claims 32, 37, 44, 50 and 54 are rejected under 35 USC 112, second paragraph. The claims are amended herein. The amendment to claims 32, 44 and 50 re-writes the claims to clarify the meaning thereof without further limiting the subject matter of these claims. The amendment to claim 37 is supported by the description on page 9, line 27. Withdrawal of the rejection is requested.

The present invention relates to a process for the production of paper comprising the addition to an aqueous cellulosic suspension of drainage and retention aids comprising an anionic microparticulate material and a cationic organic polymer having a non-aromatic hydrophobic group. The invention provides improved drainage or dewatering when producing paper from high conductivity aqueous cellulosic suspensions.

The drainage improvements of the invention are evident from the examples of the present application:

Example 2 shows an evaluation of drainage performance for two cationic organic polymers, P1 and Ref. 1, when used in combination with anionic silica-based particles. P1 is a cationic polymer prepared by polymerising acrylamide (90 mole%), and acryloxyethyl dimethyl n-butyl ammonium chloride (10 mole%). Ref. 1 is a cationic polymer prepared by polymerising acrylamide (90 mole%) and acryloxyethyl trimethyl ammonium chloride (10 mole%). Paper was produced from an aqueous cellulosic suspension having a conductivity of 2.5 mS/cm. When adding, for instance, silica-based particles (1.5 kg/ton, calculated as SiO_2 and based on dry suspension) and Ref. 1 in amounts of 0.5, 1.0, 1.5 and 2.0 kg/ton,

(based on dry suspension) the dewatering times obtained were 12.0, 9.0, 6.5, and 5.1 seconds, respectively, whereas P1 resulted in dewatering times of 11.6, 8.9, 5.8, and 4.7 seconds, respectively. The process according to the present invention thus resulted in improved drainage rate.

Likewise, example 7 shows a drainage evaluation using high conductivity cellulosic suspensions by comparing three different polymers of the present invention with a reference polymer when used in conjunction with bentonite. The three polymers of the invention were:

P1: Copolymer of acrylamide (90 mole%), and
acryloxyethyl dimethyl n-butylammonium chloride (10 mole%);

P2: Copolymer of acrylamide (90 mole%) and
acryloxyethyl dimethyl methylcyclohexylammonium chloride (10 mole%);

P3: Copolymer of acrylamide (90 mole%),
methacryloxyaminopropyl trimethylammonium chloride (5 mole%), and
methacryloxyethyl t-butylamine (5 mole%).

The reference polymer was:

Ref. 1: Copolymer of acrylamide (90 mole%), and
acryloxyethyl trimethylammonium chloride (10 mole%).

The results of the tests showed that the process of the present invention provided improved drainage rate compared to the process used for comparison.

In addition, the polymers P4 and P5 represent the polymers claimed in claim 46 of the present application. The improvements obtained using these polymers are evident from example 5 of the present application.

Claims 26-28, 30-32, 41, 43, 44-50, 52-55 are rejected under 35 U.S.C. 102(b) as anticipated by or, under 35 U.S.C. 103(a) as obvious over **Sofia et al.** (US 4,795,531), **Greenwood** (US 5,876,563), or **Langley et al.** (US 4,913,775)

Sofia et al. discloses dewatering of paper during the papermaking process. The method includes applying a low molecular weight ("LMW") cationic polymer to pulp, then adding colloidal silica and a high molecular weight ("HMW") charged acrylamide polymer. Sofia et al. does not disclose the cationic polymers of the present invention. It should be noted that one of the HMW charged acrylamide polymers disclosed is methacrylamido propyl trimethylammonium chloride homopolymer ("MAPTAC"). MAPTAC has three terminal n-methyl groups and these do not read on the present claims. The propyl unit in MAPTAC is attached as a chain segment ($-CH_2-CH_2-CH_2-$) and not as a terminal alkyl group of the type n-propyl ($-CH_2-CH_2-CH_3$) and iso-propyl ($-CH(CH_3)_2$) as defined in the present claims. In addition, Sofia et al. does not disclose dewatering of a cellulosic suspension having a conductivity of at least 2.0 mS/cm. Consequently, the presently claimed invention is not anticipated by Sofia et al.

Sofia et al. does also not teach or suggest the cationic organic polymers having a non-aromatic hydrophobic group according to the present invention. Sofia et al. does not teach or suggest dewatering of a cellulosic suspensions having a conductivity of at least 2.0 mS/cm. Thus, the presently claimed invention is non-obvious over Sofia et al.

Greenwood discloses a process for making paper which process comprises adding to a cellulosic suspension an aqueous solution of polymeric retention aid selected from dissolved cationic starch and synthetic polymer and an aqueous suspension of microparticulate anionic material. Greenwood does not mention dewatering of a suspension containing cellulosic fibres having a conductivity of at least 2.0 mS/cm. Greenwood also does not disclose the polymers as claimed in claim 46 of the present application. Thus, the invention according to the presently claimed invention is not anticipated by Greenwood.

The object of Greenwood is to improve the strength of the paper produced by incorporation of higher starch levels in the paper. However, Greenwood is silent about improving drainage. It is respectfully submitted that Greenwood teaches the

use of cationic organic polymers of the type used for comparison purposes in the examples of the present application; Greenwood in example 1, col. 19, lines 1-3; example 2, column 20, lines 38-39; example 4, col. 21, lines 53-54; example 5, col. 22, lines 57-58; and example 7, col. 23, lines 52-55 teaches the use of a copolymer of acrylamide and dimethylaminoethyl acrylate quaternary salt (DMAEAqMeCl), obviously the methyl chloride quaternary salt. This polymer corresponds to Ref. 1 and Ref. 2 used for comparison in the examples of the present application.

Accordingly, Greenwood teaches other cationic organic polymers than the ones claimed according to the present invention. There is no indication whatsoever in Greenwood that other types of cationic organic polymers could or would have any advantage in any other application. When trying to provide a paper making process with improved dewatering, notably when using high conductivity aqueous cellulosic suspensions with conductivity levels of at least 2.0 mS/cm, one of ordinary skill in the art would not search for any information in Greenwood since this reference is silent about improvements in dewatering and does not disclose high conductivity cellulosic suspensions.

Langley et al. discloses a process for the production of paper and paper board by providing an aqueous cellulosic suspension, adding to the suspension a substantially linear synthetic cationic polymer having molecular weight above 500,000 and bentonite. Langley et al. does not disclose dewatering of a cellulosic suspension having a conductivity of at least 2.0 mS/cm. Langley et al. does also not disclose the polymers claimed in claim 46 according to the present invention. Thus, the presently claimed invention is not anticipated by Langley et al.

Langley et al. does not suggest using the process for production of paper and paper board from a cellulosic suspension having a conductivity of at least 2.0 mS/cm. In addition, one of ordinary skill in the art gets no information from Langley et al. about the presently claimed invention and its benefits. It is respectfully submitted that also Langley et al. (see, for instance, column 14, lines

10 to 30) suggests cationic organic polymers of the type used for comparison purposes in the examples of the present application (Ref. 1 and Ref. 2 according to the examples of the present application are prepared from acrylamide and acryloxyethyl trimethyl ammonium chloride, which is the same as dimethylamino-ethylacrylate methyl chloride quaternary salt of Langley et al.). Hereby Langley et al. teaches other cationic organic polymers than the ones presently claimed. There is also no indication in Langley et al. that other types of cationic organic polymers could or would have any advantage in any other application. Thus, the presently claimed invention is non-obvious over Langley et al.

Claims 26-45 are rejected under 35 U.S.C. 103(a) as obvious over **Linharts et al.** (US 4,465,555), **Baron et al.** (US 4,894,119) or **Wong Shing et al.** (US 6,071,379) in view of **Sofia et al.** (US 4,795,531) or **Langley et al.** (US 4,913,775). The Examiner has also rejected claims 46-55 under 35 U.S.C. 102(a or b) as anticipated by **Baron et al.** (US 4,894,119), **Linharts et al.** (US 4,465,555) or **Wong Shing et al.** (US 6,071,379).

Linharts et al. teaches water-soluble homopolymers and copolymers of di-C_1-C_3-alkylamino neopentyl(meth)acrylates used as drainage agents, retention agents and flocculants in papermaking. Firstly, with regard to the rejection under 35 U.S.C. 102(a or b), Linharts et al. does not disclose the cationic organic polymers presently claimed in claim 46 and hence claims 46-55 are not anticipated by Linharts et al.

Secondly, with regard to the rejection under 35 U.S.C. 103(a), Linharts et al. does not suggest using the homopolymers and copolymers together with an anionic microparticulate material, also not together with anionic silica-based particles. Linharts et al. does also not suggest using the homopolymers and copolymers in dewatering of a cellulosic suspension having a conductivity of at least 2.0 mS/cm. Consequently, even if the teachings of Linharts et al. were combined with the disclosures of Sofia et al. or Langley et al., this would lead one of ordinary skill in the art to the presently claimed invention. Thus, the claims of

the present invention is non-obvious over Linharts et al. in view of Sofia et al. or Langley et al.

Baron et al. teaches the combined use of cationic and nonionic polymers as drainage and/or retention aid. Baron et al. does not disclose the cationic organic polymers presently claimed in claims 46-55.

The cationic polymer of Baron et al. is not suggested for use together with an anionic microparticulate material, not suggested for use together with anionic silica-based particles, and also not suggested for use in the production of paper from a cellulosic suspension having a conductivity of at least 2.0 mS/cm. Also in this case, a combination of the teachings of Baron et al. with the disclosures of Sofia et al. or Langley et al. would not lead one of ordinary skill in the art to arrive at the presently claimed invention. Hereby the claims of the present invention is non-obvious over Linharts et al. in view of Sofia et al. or Langley et al.

Wong Shing et al. discloses a method for improving retention and drainage in papermaking by the use of hydrophilic dispersion copolymers of diallyl-N,N-disubstituted ammonium halide, wherein the disubstituted halide is selected from the group consisting of C_1-C_{20} alkyl groups, and (meth)acrylamide.

Wong Shing et al. does not suggest co-using the hydrophilic dispersion copolymers with an anionic microparticulate material, and not together with anionic silica-based particles, and they are also not suggested to be used in the production of paper from a cellulosic suspension having a conductivity of at least 2.0 mS/cm. Likewise, even if teachings of Baron et al. were combined with the disclosures of Sofia et al. or Langley et al., one of ordinary skill in the art would not arrive at the presently claimed invention. The claims of the present invention are non-obvious over Wong Shing et al. in view of Sofia et al. or Langley et al.

In summary, applicant respectfully submit that the allegedly obvious combinations suggested in the Office Action could not possibly have been made

without hindsight reliance on applicant's disclosure since it is only applicant's disclosure which provides the requisite motivation for such a combination.

Respectfully submitted,

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26. (Amended) A process for the production of paper which comprises:

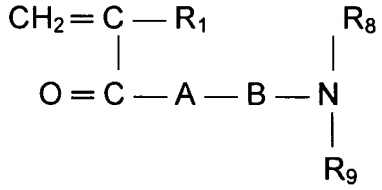
(i) providing a suspension containing cellulosic fibres, and optional fillers;

(ii) adding to the suspension drainage and retention aids comprising an anionic microparticulate material and a cationic organic polymer having a non-aromatic hydrophobic group which is an alkyl group containing at least 3 carbon atoms selected from the group consisting of n-propyl, iso-propyl, n-butyl, iso-butyl, t-butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl and dodecyl; and

(iii) forming and dewatering the obtained suspension on a wire; the suspension that is dewatered on the wire having a conductivity of at least 2.0 mS/cm.

32. (Amended) The process of claim 26, wherein the cationic organic polymer comprises in polymerized form a non-ionic monomer having a non-aromatic hydrophobic group represented by the general formula (IV):

(IV)



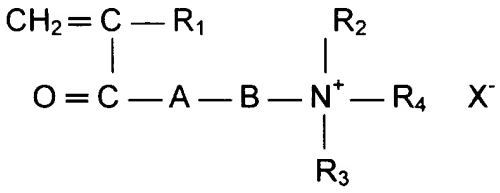
wherein R_1 is H or CH_3; A is O or NH; B is an alkylene group of from 2 to 4 carbon atoms or a hydroxy propylene group or, alternatively, A and B [are both nothing whereby there is] represent a single bond between C and N (O=C—NR_8R_9); and R_8 and R_9 are each H or a substituent containing an alkyl group having from 1 to 6 carbon atoms, at least one of R_8 and R_9 being a substituent containing an alkyl group having from 3 to 4 carbon atoms.

37. (Amended) The process of claim 36, wherein the [drainage and retention aids further comprise a low molecular weight cationic organic polymer] low molecular weight cationic organic polymer has a molecular weight up to about 700.000.

38. (Amended) The process of claim 26, wherein the suspension that is dewatered on the wire has a conductivity of at least [2.0] 3.5 mS/cm.

41. (Amended) A process for the production of paper which comprises:
(i) providing a suspension containing cellulosic fibres, and optional fillers;
(ii) adding to the suspension drainage and retention aids comprising a cationic organic polymer and anionic silica-based particles; and
(iii) forming and dewatering the suspension on a wire; the suspension that is dewatered on the wire having a conductivity of at least 2.0 mS/cm;
wherein the cationic organic polymer comprises in polymerized form one or more monomers comprising at least one cationic monomer having a non-aromatic hydrophobic group represented by the general formula (I):

(I)

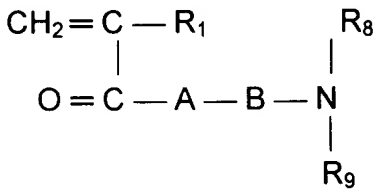


wherein R_1 is H or CH_3; R_2 and R_3 are each H or an alkyl group having from 1 to 3 carbon atoms; A is O or NH; B is an alkylene group of from 2 to 8 carbon atoms or a hydroxy propylene group; R_4 is a substituent containing a non-aromatic hydrophobic group containing from 3 to 12 carbon atoms; and X^- is an anionic counterion.

44. (Amended) A process for the production of paper which comprises:
(i) providing a suspension containing cellulosic fibres, and optional fillers;
(ii) adding to the suspension drainage and retention aids comprising a cationic organic polymer and anionic silica-based particles; and
(iii) forming and dewatering the suspension on a wire; the suspension that is dewatered on the wire having a conductivity of at least 2.0 mS/cm;

wherein the cationic organic polymer comprises in polymerized form one or more monomers comprising at least one non-ionic monomer having a non-aromatic hydrophobic group represented by the general formula (IV):

(IV)



wherein R_1 is H or CH_3; A is O or NH; B is an alkylene group of from 2 to 8 carbon atoms or a hydroxy propylene group or, alternatively, A and B [are both nothing whereby there is] represent a single bond between C and N (O= C—NR_8R_9); and R_8 and R_9 are each H or a substituent containing a non-aromatic hydrophobic group having from 1 to 6 carbon atoms, at least one of R_8 and R_9 being a substituent containing a non-aromatic hydrophobic group having from 2 to 6 carbon atoms.

46. (Amended) A cationic vinyl addition polymer comprising in polymerized form [at least one non-cationic monomer having a non-aromatic hydrophobic group, at least one cationic monomer and (meth)acrylamide, wherein the cationic vinyl addition polymer is prepared from a monomer mixture comprising from 75 to 95 mole% of (meth)acrylamide]

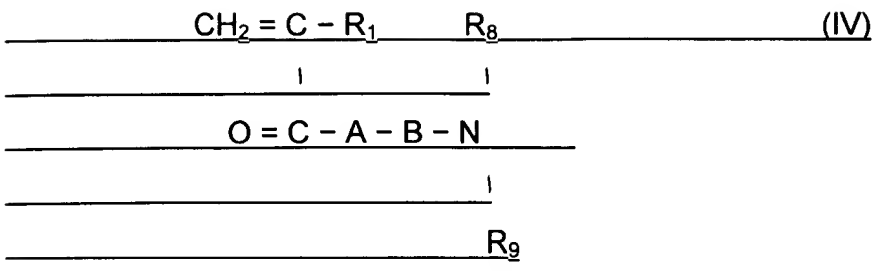
(a) at least one non-cationic monomer having a non-aromatic hydrophobic monomer;

(b) at least one cationic monomer; and

(c) (meth)acrylamide;

wherein the cationic vinyl addition polymer is prepared from a monomer mixture comprising from 75 to 95 mole% of (meth)acrylamide;

(a) said at least one non-cationic monomer having a non-aromatic hydrophobic group comprising a monomer represented by the general formula (IV)

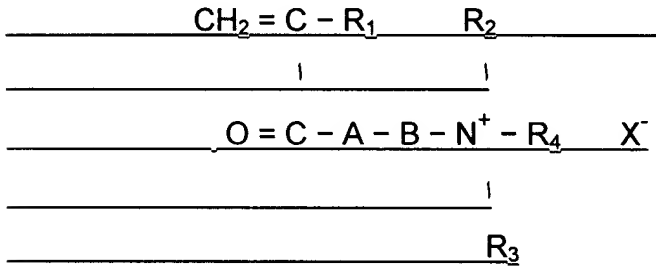


(IV)

wherein R_1 is H or CH_3; A and B represent a single bond between C and N (O=C–NR_8R_9); R_8 and R_9 are each H or a substituent containing an alkyl group having from 1 to 6 carbon atoms, at least one of R_8 and R_9 being a substituent containing an alkyl group having from 2 to 6 carbon atoms;

(b) said at least one cationic monomer comprising a cationic monomer selected from the group consisting of:

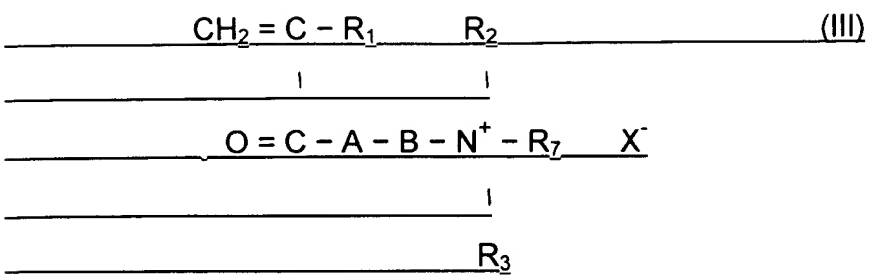
(i) cationic monomers represented by the general formula (I):



(I)

wherein R_1 is H or CH_3; R_2 and R_3 are each H or an alkyl group having from 1 to 3 carbon atoms; A is O or NH; B is an alkylene group of from 2 to 4 carbon atoms or a hydroxy propylene group; R_4 is a non-aromatic hydrocarbon group containing from 4 to 8 carbon atoms; and X^- is an anionic counterion;

(ii) cationic monomers represented by the general formula (III):



(III)

wherein R_1 is H or CH_3; R_2 and R_3 are each H or an alkyl group having from 1 to 3 carbon atoms; A is O or NH; B is an alkylene group of from 2 to 4 carbon atoms, or a hydroxy propylene group; R_7 is H, an alkyl group having from 1 to 3 carbon atoms, a benzyl group or a phenylethyl group; and X^- is an anionic counterion;

(iii) and mixtures thereof.